

Assessment of Lung Ultrasound Artifacts (B-Lines)

Incremental Contribution to Echocardiography in Heart Failure?

We read with a great interest the paper by Miglioranza et al. (1), which sought to define the performance of lung ultrasound (LUS) compared with a clinical congestion score, natriuretic peptides, and echocardiography, to evaluate decompensation in patients with systolic heart failure (HF) in an outpatient clinic. This paper is a valuable effort to bridge the gap between echocardiography and thoracic ultrasound, and their separate skills and application—a topic that is still quite controversial (2).

Nonetheless, we remain skeptical about the value of this test. Four methodological observations seem relevant. First, the specificity of LUS B-lines is suboptimal: in addition to pulmonary congestion, these are visible in chronic obstructive pulmonary disease (3), pulmonary fibrosis (4), and lymphangitis (2,4). Second, the evaluation process is at best semiquantitative, because the method is more of a subjective overview than an actual “measurement.” Third, most reference studies have used linear or convex probes rather than phased array transducers; the use of phased-array transducers provides a greater risk of artifacts, depending on machine settings and particularly at lower frequencies. Finally, the actual interobserver and intraobserver measurement range is not reported (1).

There are also some practical issues that warrant further attention. First, although the authors state that “this technique is faster to perform, is less expensive, and has lower technical requirements compared with a full echocardiography examination,” such a comparison of cost and return needs formal study. Second, the statement “LUS could be used as an extension of the physical examination and to differentiate hemodynamic from pulmonary congestion” warrants examination in a mixed patient group with pulmonary disease, to truly evaluate the ability to perform this differentiation. Third, in our opinion, the implication of the article that pharmacological therapy could be tailored as soon as the patient, although asymptomatic, shows a significant increase in the number of B-lines is speculative and not yet supported by solid evidence.

In conclusion, we think that a critical reappraisal of this and other similar papers published on B-lines is mandatory. The evaluation of these artifacts using subjective scores is contrary to efforts to improve the reliability and objectivity of imaging (3–5).

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- ## B-Lines: To Count or Not to Count?
- We found the paper by Miglioranza et al. (1) interesting and useful for routine clinical practice because their purpose is that of simplifying and obtaining from an ultrasound B-line count a measure of lung water, a “measure” of disease, that would be approachable by all, with a short period of training. Some points, though, need to be clarified because, unfortunately, the concept of B-line is not just that.
- The investigators define B-lines according to a consensus statement in which only a “qualitative” description is provided without any explanation of their origin (2), which is still debated in the literature (3). We know from past studies that these artifacts are an expression of an error of the ultrasound machine in interpreting acoustic interactions, so we do not agree that a simple “count” of B-lines could be an “unambiguous” measure of extravascular lung water (EVLW), because an increase in EVLW is not the sole origin of these artifacts.
- In the study (1), to rule out false positives, only patients with a prior diagnosis of pulmonary fibrosis were excluded. But B-lines are found in many other pulmonary conditions, such as pneumonia, atelectasis, acute lung injury/acute respiratory distress syndrome, pleural disease, and actually any ground-glass opacity seen in CT scans. They are a very sensitive but, unfortunately, a very nonspecific sign. Is it, with this optic, possible to “count” an ambiguous phenomena, with debated and artifactual origin, to define a “cutoff” parameter related to EVLW in decompensated congestive heart failure? Other authors are pushing in this direction, and recently, Brattain et al. (4) have tested portable sonography with an algorithm to count and formulate a score of EVLW. Although promising, we would like to advise practitioners to be on guard on this subject because the risk of underestimating a problem by simplifying it is, yes, attractive, but could have serious clinical implications (i.e., when mechanically ventilating a patient in the intensive care unit: the origin of disease cannot be overseen).
- In the study, in all but 2 patients, lung ultrasound was performed in the anterolateral surface of each hemithorax, following international recommendations (2), whereas the chest x-ray was always carried out in orthostatism. We know how water distribution in pulmonary congestion tends to accumulate in the posteroinferior, antigravitational regions: why not use the same position? Was there a difference between the 2 approaches?
- Moreover, the investigators use a cardiac probe (2.5 to 3.5 MHz), although it is to date common knowledge in the field that the number and features of B-lines change when examined with different probes and at different angles of assessment (5). What would be the best probe setting to carry out a repeatable count with the least interoperator variability?
- In conclusion, the description of extension (focal/bilateral), localization, involvement (homogeneous/dishomogeneous), and